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TWENTY-FIRST ANNUAL REPORT OF THE DIRECTOR.

SUBMITTED TO THE TRUSTEES JANUARY 12, 1910.

To the Board of Trustees of the Missouri Botanical Garden:

The following report on the Missouri Botanical Garden and the School of Botany therewith connected is respectfully submitted, in compliance with your rules.

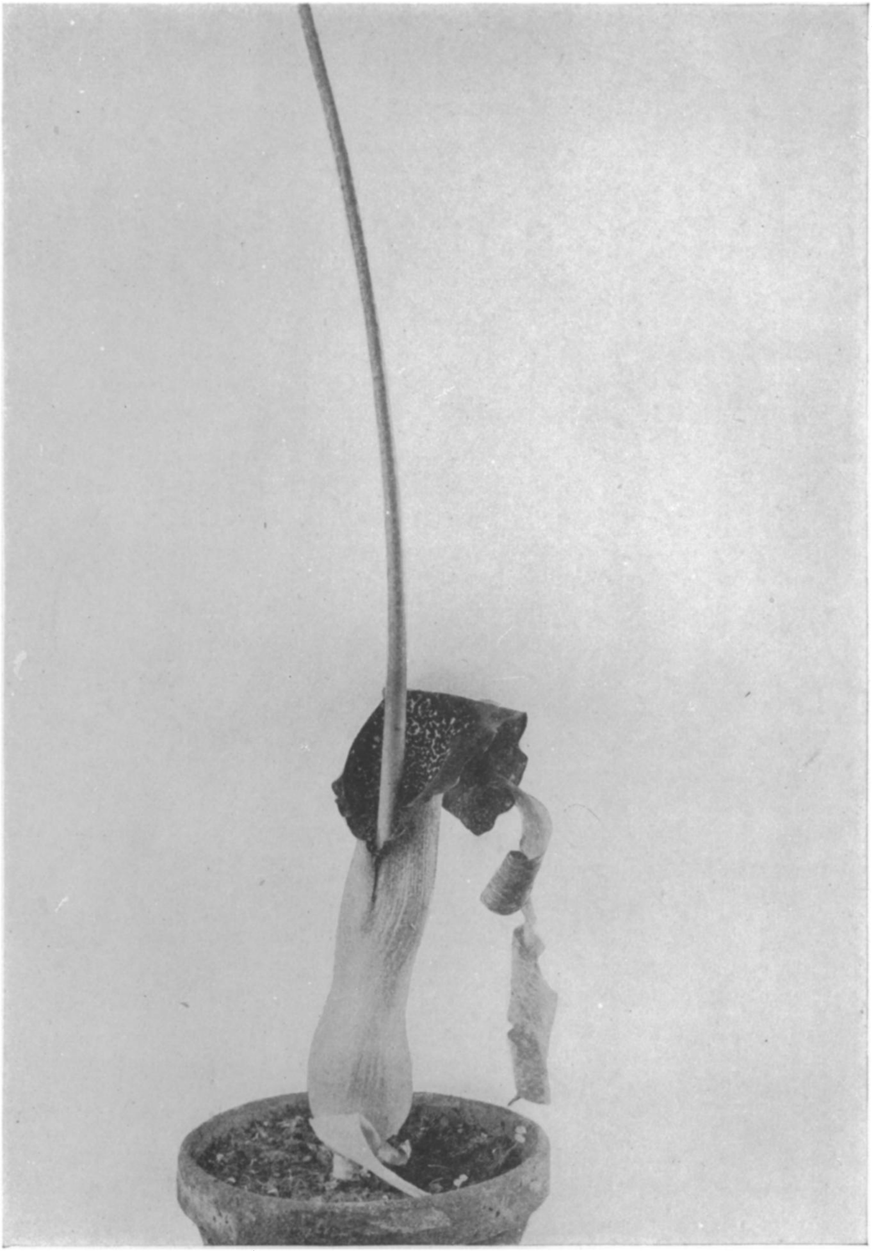
GARDENING.

Decorative gardening in 1909 followed essentially the same lines as for several years past, the most observable changes consisting in modification of the borders flanking the entrance, in the substitution of foliage for flowering plants in the sunken garden, and in the use of more than the usual number of succulents in attractive and skillful mosaic designs. In the early spring the sunken garden and its surroundings were devoted to tulips, as has been the case for several years past, and the display of these flowers was extended by planting additional beds with the brilliant, late-blooming "parrot" varieties. Aside from the tulips, of which 28,800 plants representing 222 varieties were used, the bedding plants placed during the season numbered 33,000.

Chrysanthemums were again grown in numbers, and 3,511 plants, of 520 varieties, were shown under canvas through the fortnight beginning with November 15th. Though the season had been less favorable than usual for the growth of these plants, and the specimen plants were not as large as in some earlier years, a very creditable display was made, and in variety of instructive forms this collection has not before been equaled.

About 2,500 Oenotheras, grown from pedigree-seed, added much to the attractiveness of the Garden in the early evening during the summer, because of their profuse production of large and fragrant flowers, though they were intended primarily for research use.

Plant and seed accessions, apart from those propagated or collected at the Garden, number 326, and comprise 16,433



A SAUROMATUM.

plants or packets of seeds of which 9,960, corresponding to 31 accession entries, were purchased at a cost, including transportation charges, of $759.78; 6,473, representing 295 of the accessions, valued at $694.82, were presented; and 3,271, or 39 accessions, valued at $194.03, were collected by Garden employees—in addition to a large number of seeds for exchange purposes. Garden propagations amounted to 23,618 plants, valued at $1,653.26; and 13,250 seedlings, valued at $662.50, were also raised by the gardeners.

The exchange seed list issued by the Garden last winter included 2,369 species or named varieties; and 8,159 packets of seeds, valued at $407.95, selected from the list have been issued to correspondents. Living plants to the number of 169, valued at $16.30, have been similarly distributed. In addition to these exchanges 207 duplicate plants, valued at $26.20, have been presented to schools and colleges for educational use, and 1,133 surplus plants, removed from the grounds on the approach of winter or remaining after the spring planting, were given to schools and playgrounds. Chrysanthemum plants which were still usable, numbering 208, and many cut flowers from others, were distributed to hospitals and similar charities after the November exhibition.

PLANTS CULTIVATED.

During the year 822 species or varieties were added to the collection, and 520 lost or discarded, leaving a net recorded gain of 302, and bringing the total at the end of the year to 11,764, as compared with the 11,464 noted for 1908.[1] These forms represent 1,777 genera, belonging to the following 197 families of plants:

FAMILIES	GENERA	SPECIES
Acanthaceae	14	35
Aceraceae	2	36
Agaricaceae	1	5
Alismaceae	3	10
Aizoaceae	4	16
Amarantaceae	14	45
Amaryllidaceae	25	366
Anacardiaceae	8	32
Anonaceae	3	6
Apocynaceae	17	34
Aponogetonaceae	1	1
Aquifoliaceae	2	10
Araceae	32	254
Araliaceae	9	36

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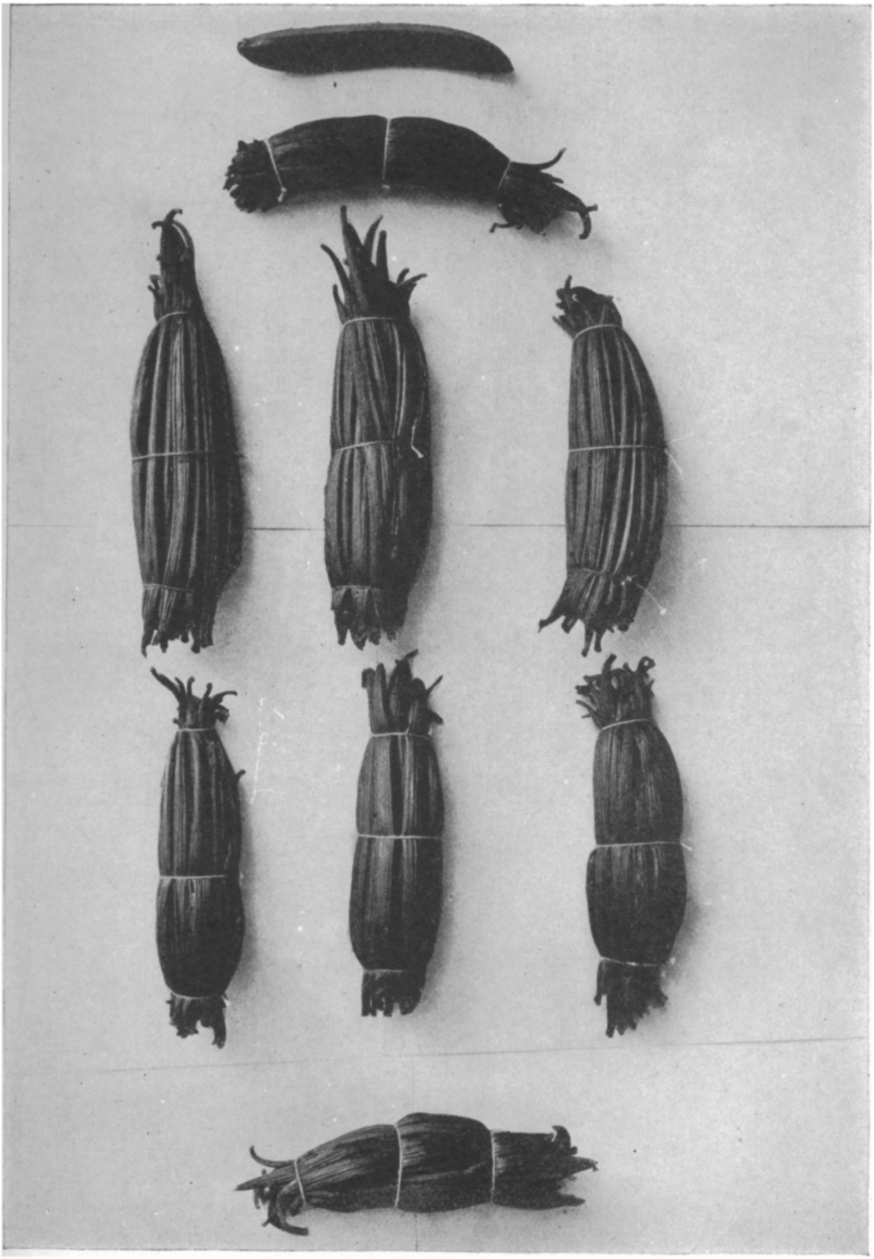
[1] Rept. Mo. Bot. Gard. **20**:15.

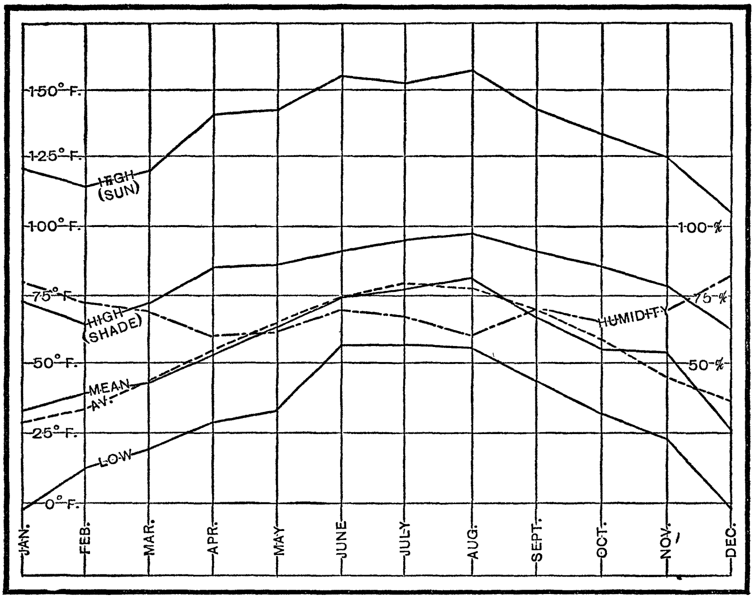
Families	Genera	Species
Aristolochiaceae	2	16
Asclepiadaceae	20	114
Balsaminaceae	1	8
Begoniaceae	1	51
Berberidaceae	5	33
Betulaceae	5	41
Bignoniaceae	17	55
Bixaceae	1	1
Bombaceae	6	7
Borraginaceae	19	40
Bromeliaceae	15	122
Brunelliaceae	1	2
Burseraceae	2	2
Butomaceae	2	2
Buxaceae	3	6
Cactaceae	21	603
Calycanthaceae	2	5
Campanulaceae	10	76
Cannaceae	1	215
Capparidaceae	4	9
Caprifoliaceae	8	86
Caricaceae	1	3
Caryophyllaceae	12	125
Casuarinaceae	1	6
Celastraceae	4	25
Chenopodiaceae	12	60
Chloranthaceae	1	1
Cistaceae	3	24
Clethraceae	1	1
Cneoraceae	1	1
Cochlospermaceae	1	1
Combretaceae	3	8
Commelinaceae	9	28
Compositae	121	1260
Convolvulaceae	7	26
Coriariaceae	1	1
Cornaceae	3	24
Corynocarpaceae	1	1
Crassulaceae	20	160
Cruciferae	30	173
Cucurbitaceae	19	91
Cycadaceae	6	29
Cyclanthaceae	1	1
Cyperaceae	10	56
Cyrillaceae	1	1
Diapensiaceae	1	1
Dilleniaceae	4	4
Dioscoreaceae	1	8
Dipsacaceae	4	29
Droseraceae	2	4
Ebenaceae	3	7
Elaeagnaceae	3	12
Empetraceae	1	1
Equisetaceae	1	3
Ericaceae	13	52
Eriocaulaceae	1	1
Euphorbiaceae	23	158
Fagaceae	3	50
Filicineae	44	187
Flacourtiaceae	4	5
Fouquieriaceae	1	2
Gentianaceae	3	5
Geraniaceae	3	94
Gesneriaceae	15	108
Ginkgoaceae	1	1
Gnetaceae	1	2
Gramineae	84	301
Guttiferae	8	35
Haemodoraceae	2	2
Halorrhagidaceae	2	2
Hamamelidaceae	3	3
Hippocastanaceae	1	7
Hydrocharitaceae	3	4
Hydrophyllaceae	5	11
Icacinaceae	1	1
Iridaceae	18	232
Juglandaceae	3	16
Juncaceae	3	22
Juncaginaceae	1	2
Labiatae	43	173
Lardizabalaceae	2	2
Lauraceae	10	12
Lecythidaceae	3	3
Leguminosae	117	537
Leitneriaceae	1	1
Lemnaceae	1	1
Lentibulariaceae	1	1
Liliaceae	77	792
Linaceae	2	18
Loasaceae	3	3
Loganiaceae	5	13
Loranthaceae	1	1

Families	Genera	Species
Lycopodiaceae	1	1
Lythraceae	6	21
Magnoliaceae	5	23
Malpighiaceae	6	8
Malvaceae	22	96
Marantaceae	4	24
Marchantiaceae	6	10
Marsileaceae	2	3
Martyniaceae	2	8
Melastomaceae	6	8
Meliaceae	5	7
Melianthaceae	1	2
Menispermaceae	6	9
Moraceae	16	64
Moringaceae	1	1
Musaceae	3	14
Myricaceae	1	4
Myrsinaceae	3	12
Myrtaceae	18	98
Nepenthaceae	1	32
Nolanaceae	1	4
Nyctaginaceae	3	10
Nymphaeaceae	6	61
Ochnaceae	1	1
Oleaceae	10	135
Onagraceae	9	61
Orchidaceae	99	640
Oxalidaceae	3	45
Palmae	39	86
Pandanaceae	1	11
Papaveraceae	13	80
Passifloraceae	1	7
Pedaliaceae	1	1
Phytolaccaceae	5	12
Pinaceae	16	101
Piperaceae	2	12
Pittosporaceae	3	19
Plantaginaceae	1	23
Platanaceae	1	4
Plumbaginaceae	4	29
Polemoniaceae	3	35
Polygalaceae	1	3
Polygonaceae	12	63
Pontederiaceae	3	4
Portulacaceae	5	25
Potamogetonaceae	1	3
Primulaceae	7	57
Proteaceae	3	6
Punicaceae	1	2
Ranunculaceae	20	285
Resedaceae	3	13
Rhamnaceae	11	37
Rosaceae	34	876
Rubiaceae	31	66
Rutaceae	16	32
Salicaceae	2	81
Salvadoraceae	1	1
Salviniaceae	1	1
Santalaceae	2	2
Sapindaceae	14	20
Sapotaceae	7	12
Sarraceniaceae	1	5
Saururaceae	2	2
Saxifragaceae	16	96
Scrophulariaceae	24	114
Selaginellaceae	1	7
Simarubaceae	1	1
Solanaceae	22	262
Sparganiaceae	1	1
Staphyleaceae	1	4
Sterculiaceae	8	19
Styracaceae	2	7
Symplocaceae	1	1
Taccaceae	1	3
Tamaricaceae	1	3
Taxaceae	2	8
Theaceae	5	14
Theophrastaceae	1	1
Thymelaeaceae	3	3
Tiliaceae	6	20
Tropaeolaceae	1	6
Typhaceae	1	4
Ulmaceae	4	12
Umbelliferae	38	111
Urticaceae	10	25
Valerianaceae	3	5
Verbenaceae	12	80
Violaceae	1	32
Vitaceae	3	66
Zingiberaceae	9	23
Zygophyllaceae	2	2
Totals.......197	1,777	11,764

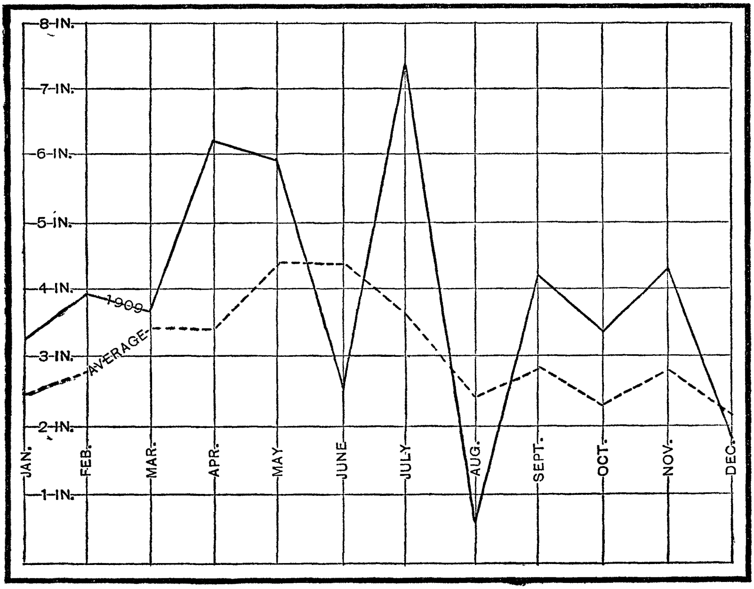


GARDEN-GROWN VANILLA.

DIAGRAMS A AND B.



A. — TEMPERATURE AND HUMIDITY, 1909.



B. — PRECIPITATION, 1909.

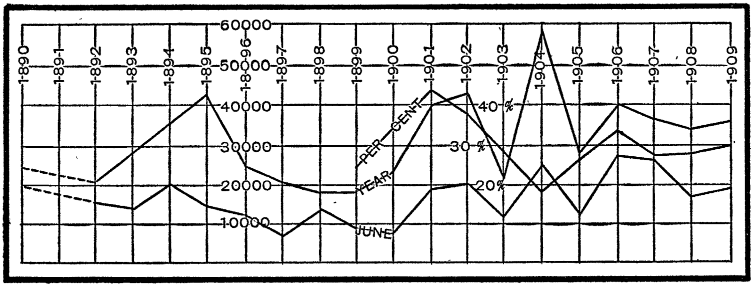
THE WEATHER.

Though January, February and November, and to a less extent August, were this year markedly warmer, and December decidedly colder, than usual, the mean temperature for the season (Diagram A) closely follows the average, except for the fall and winter months. The precipitation for the year (Diagram B) has been rather abundant (47.5 in.); but the rainfall in June was considerably below the average and less than an inch of rain fell in August, which, with the rather high temperature, increased the difficulties of gardening and especially affected the blue-grass lawns. The diagrams are derived from the local Weather Bureau records.

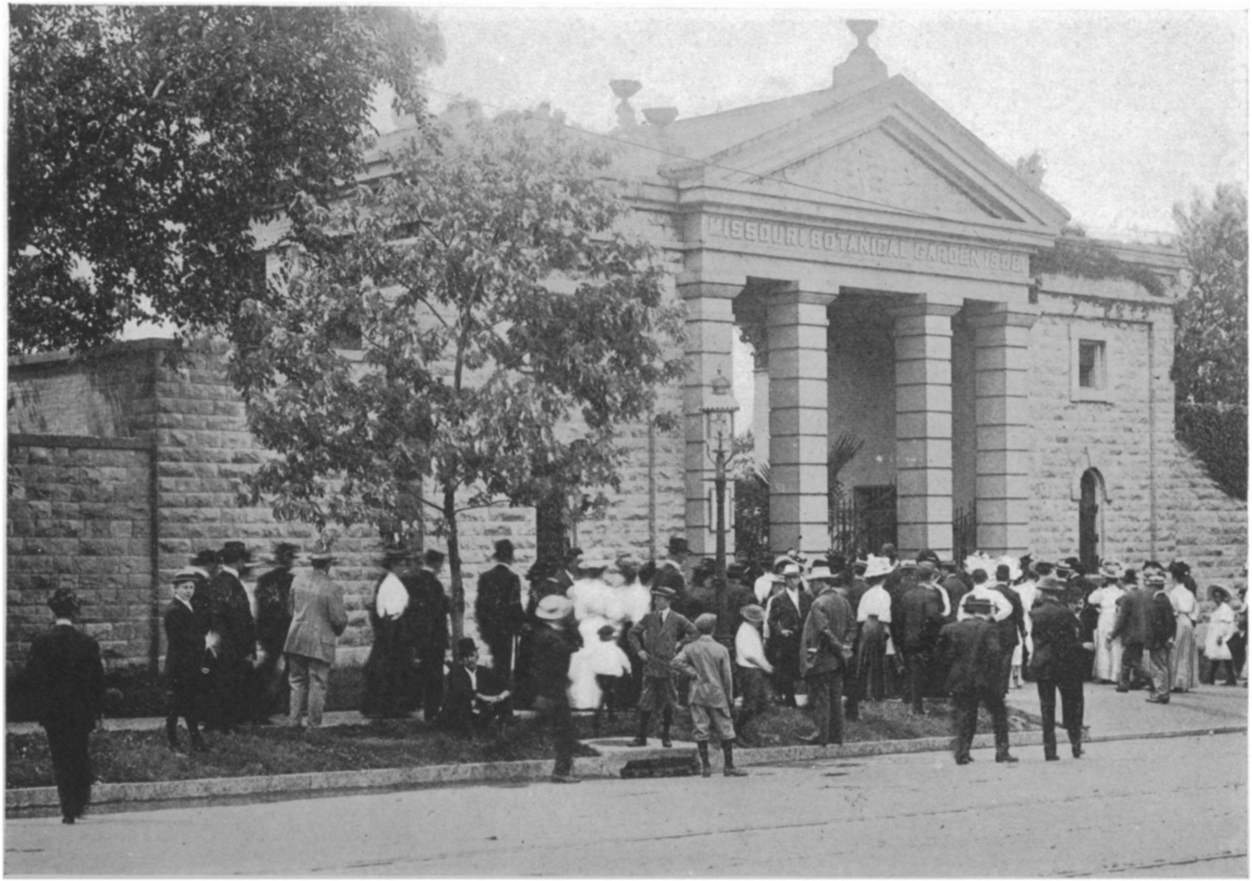
VISITORS.

A gratifying number of visitors is to be reported. As may be seen from the accompanying diagram, they closely agreed with the average for previous records in January, February, March and May, but considerably exceeded this average in the other months except December. In November, however, they fell far below the average for the past few years, though the fact that over 16,000 were recorded justifies the special chrysanthemum display by which the larger part of these were attracted—the courtesy of Captain Robert McCulloch having again made possible the lighting of the tent so that it might be opened in the evening.

DIAGRAM C.



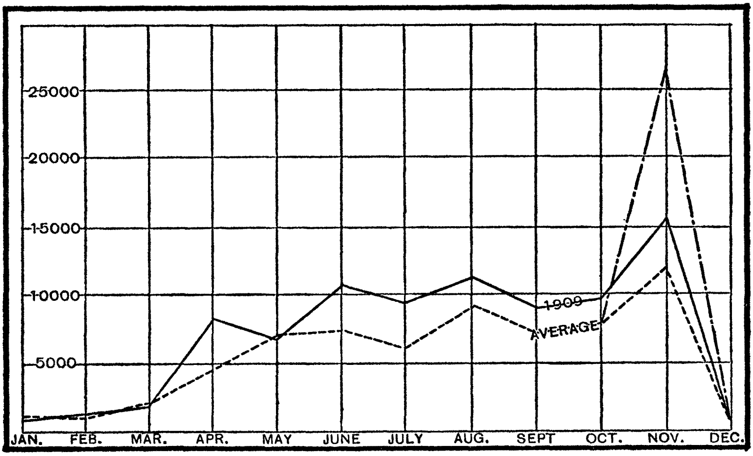
SUNDAY VISITORS, 1890 TO 1909.



ON AN "OPEN SUNDAY."

The number of visitors for 1909 is 120,748, of whom 18,379 were recorded on the first Sunday afternoon in June and 17,572 on the first Sunday afternoon in September. The relation of these 35,951 Sunday visitors to those of other years, and to the total for this year (29.7%), is indicated in Diagram C. The seasonal distribution of the 84,797 week-day visitors, and its comparison with the average for earlier years, are graphically presented in Diagram D. The total recorded for 1909 has been exceeded (apart from the Exposition year) only in 1907, when the unusually large number of persons attracted by the chrysanthemums brought the number for the year to 135,497.

DIAGRAM D.



WEEK-DAY VISITORS, 1909.

THE HERBARIUM.

Rather few large purchases of specimens have been made, but the herbarium has been enlarged by the customary current collections offered for sale. Advantage has been taken of the lessened purchases to have the unincorporated accumulations of recent years mounted; and relatively little unmounted material now remains. Eight hundred duplicate specimens, valued at $40.00, were distributed to correspondents during the year.

The additions to the mounted collection in 1909 number 36,959 sheets of specimens, of which 6,344, valued (unmounted) at $317.20, were presented; 2,332, valued at $116.60, were collected by employees; and 28,283 were purchased, the Secretary's books showing an expenditure of $1,508.69 for specimens and material during the year.

The herbarium, so far as now mounted, consists of:

The Engelmann Herbarium (all groups)		97,859	specimens.
The General Herbarium: —			
Higher plants.			
The J. J. Bernhardi Herbarium .	62,507		
The Henry Eggert Herbarium[2] .	26,703		
The J. H. Redfield Herbarium .	16,447		
The Sturtevant and Smith Herbarium	7,446		
The Gustav Jermy Herbarium .	5,118		
The A. W. Chapman Herbarium[2]	3,536		
The Julien Reverchon Herbarium[2]	17,210		
The Nicholas Riehl Herbarium .	3,359		
Other specimens	362,099	504,425	"
Thallophytes.			
The J. J. Bernhardi Herbarium[2]	3,191		
The Gustav Jermy Herbarium .	1,659		
The S. M. Tracy Herbarium[2] .	4,334		
The Wm. Trelease Herbarium .	11,000		
Other specimens	33,357	53,541	"
Making a total of		655,825	"
Valued at			$98,373.75

Supplementing the herbarium, and the shelved or incorporated exsiccatae, which are here counted as a part of it,[4] the Garden possesses specimens of economic plant-products, woods, seeds, etc., valued at $280.00, and 1,851 preparations for microscopic study, valued at $410.00, which have not been added to since their enumeration in my last report.[5]

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[2] So far as yet incorporated.

[3] This valuation at the rate of $15.00 per hundred mounted sheets.

[4] Rept. Mo. Bot. Gard. **16**: 21. [5] See Rept. Mo. Bot. Gard. **20**: 26.

The addition to the herbarium and library building reported last year has made it possible for the herbarium to be united under one roof again; and one floor of the new building has been equipped with steel cases, as nearly dust and insect tight as such cases can be made, the unit size adopted being a ground plan of 40¼×55¼ inches and a height of 90 inches. Advantage was taken of the necessary handling of specimens to rearrange them in the now accepted phylogenetic sequence.

THE LIBRARY.

The increase in the library during 1909 has been closely comparable with that for a number of years preceding; the more essential current publications have been procured, in addition to a number of works rounding out the library in the fields of bacteriology and phycology, though unfortunately means have not been found to add more than a very few of the earlier books which now and then appear in the market and are becoming more difficult of purchase and more costly with the passage of each year.

Additions number 883 books, valued at $1,886.45, 1,631 pamphlets, valued at $285.15, and 6 manuscripts, valued at $114.00, presented or received in exchange for Garden publications; and 485 books and 219 pamphlets bought, the expenditure for purchases and binding amounting to $2,727.80.

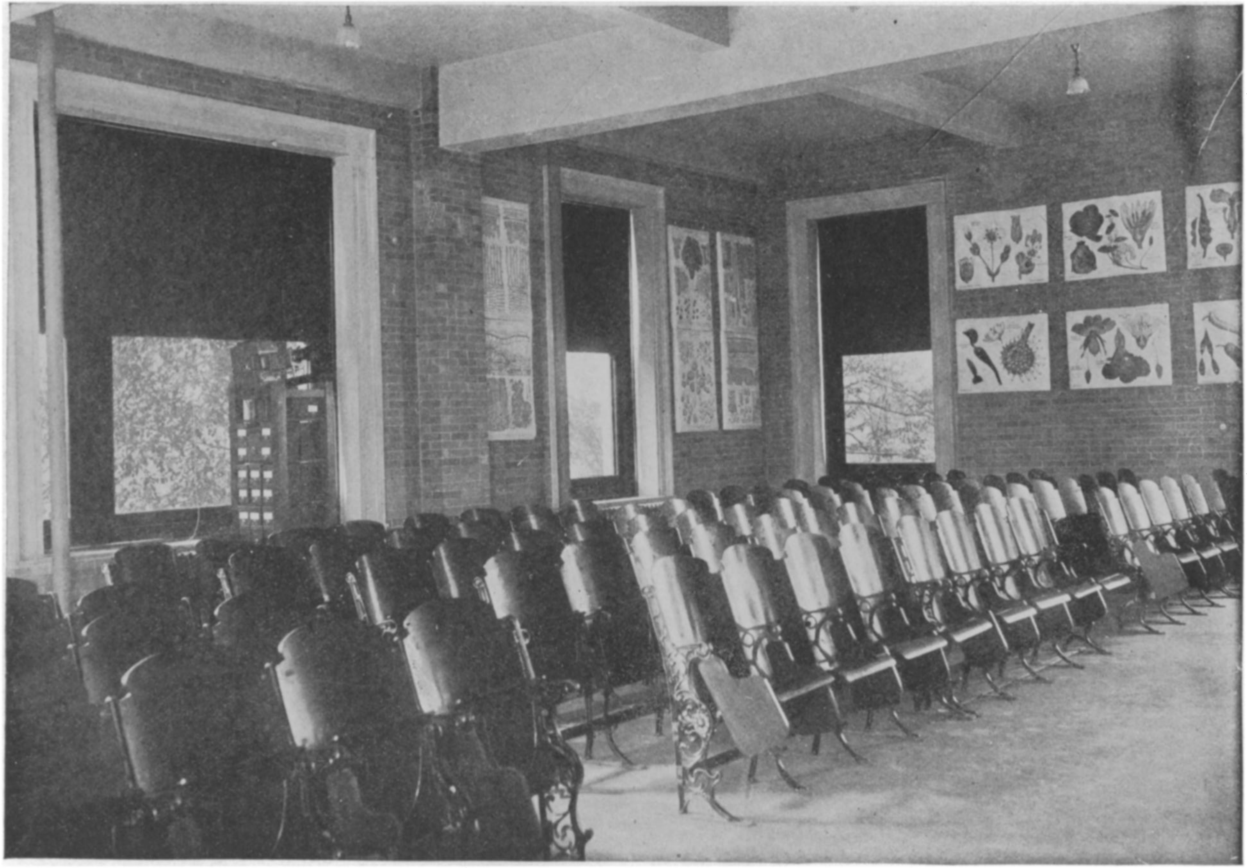
The card index has been increased by the addition of 45,533 cards, of which 35,301 were written by employees and the remainder purchased. As for several years past, in addition to indexing the plant illustrations of the library, the attendants have given special attention to references to germination and seedlings.

The serial publications now received number 1,464, of which 107 are bought and 1,357, issued by 970 institutions or publishers, are received in exchange for the Reports of the Garden. This number is twelve more than that reported last year. It is to be observed that to this exchange use of the Garden publications a large part of the yearly accessions to the library is directly attributable.

As now constituted, the library contains:

Pamphlets	36,201			
Books	25,453			
	61,654,	valued at		$96,182.79
Manuscripts:				
Engelmann, Notes and Sketches	60,	valued at	$600.00	
Engelmann, Thesis	1	" "	100.00	
Roetter, Sketches	1	" "	100.00	
Shaw, Notes	5	" "	100.00	
Sturtevant, Index Rerum	11	" "	110.00	
Price, Bird and Insect Sketches	2	" "	250.00	
Leconte, Insect Sketches	8	" "	225.00	
Bay, Bibliotheca Riviniana	1	" "	25.00	
Lindheimer, Miscellaneous	1	" "	10.00	
Theses by Garden Pupils	10	" "	10.00	
Theses by Graduate Students	8	" "	8.00	
	108	" "		1,538.00
Total	61,762	" "		$ 97,720.79
Index cards	719,377	" "		7,193.77
Total value of library				$104,914.56

Though it has not been possible to provide for the entire library under one roof, as was done for the herbarium, the addition to the library building has made it possible to bring the most-used classes of books once more together, those left in the old Museum building, though less quickly accessible, being safely housed. Two floors of the new building have been equipped with steel cases corresponding in style, length, and height with those used in the herbarium, so that books referring to a given group of plants are appropriately shelved near the specimens; both the herbarium and library are capable of rearrangements and replacements at will, as they increase and are fitted into new quarters from time to time. To correspond with the changed sequence of families in the herbarium, the portion of the library that deals directly with taxonomy has been readjusted so as to follow the same classification.



THE GRADUATE LECTURE ROOM.

RESEARCH AND THE USE OF FACILITIES.

The long-established policy of making the facilities of the garden available to investigators has been taken advantage of by a number of visiting botanists. During the year 19,771 herbarium specimens have also been loaned to 26 investigators who were unable to visit Saint Louis or who could not complete their use of material at the Garden; and 360 books or pamphlets have been loaned similarly to 73 persons.

As in previous years, such part of the time of capable employees as could be given to original study has been so used, and a number of papers have been published embodying its results.

THE HENRY SHAW SCHOOL OF BOTANY.

One of the most cherished purposes of the founder of the Garden was the provision of means and appliances for instruction in botany—referred to by him not merely as a specific science but "in its application to horticulture, arboriculture, medicine and the arts,"[6] and with special mention of "vegetable physiology, the diseases of plants, the study of the forms of vegetable life and of animal life injurious to vegetation, experimental investigations in horticulture, arboriculture, etc." [7] Inaugurated before Mr. Shaw's death by the endowment of a School of Botany as a special department of Washington University[8] with provision for the closest affiliation between this department and the Garden[9] and with authorization for the Trustees of the latter "to allot, if they think it expedient, from time to time, any of the income not needed for the development and maintenance of the said Garden to the augmentation to the means and appliances of instruction,"[10] the realization of this purpose has necessarily rested, until the present year, upon the single professorship established in 1885.

Though still burdened by the necessary cost of holding the large tracts of unimproved and unproductive real estate in which a large part of the endowment of the Garden consists, the Trustees, after careful consideration, have decided that the time has now arrived for availing themselves of the authorization given for augmenting means and appliances for instruction, and as a first step toward this they have built and equipped laboratories suited to graduate work in certain lines of botany, and have established the post of plant physiologist at the Garden. To this post, Dr. George T. Moore has been called by the Trustees, and he has been elected by the Directors of Washington University to a newly established professorship of plant physiology and applied botany in the School of Botany. In connection with this professorship, two research fellowships in botany have been established which are this year held by Mr. E. G. Arzberger and Miss Ada Hayden.

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[6] Rept. Mo. Bot. Gard. **1**:36. [7] *l. c.* **1**:37. [8] *l. c.* **1**:56–59.

[9] *l. c.* **1**:36–37. [10] *l. c.* **1**:37.

The recently published Catalogue of the University enumerates the following regular courses now offered by the School of Botany in addition to special work suited to the individual needs of advanced students who, when possible, are given such work in preference to less elastic courses:

COURSES OF INSTRUCTION. — *A. Primarily for undergraduates:* 1, 2. General Botany.—2a, Field Ecology. —3, 4. Plant Physiology. — 5. Bacteriological Methods. — 6. Histological Methods. — *B. For undergraduates and graduates:* 7. Bacteriology. — 9. Morphology and Taxonomy of Fungi. — 10. Morphology and Taxonomy of Algae. — 11. Morphology and Taxonomy of Bryophytes. — 12. Morphology and Taxonomy of Pteridophytes. — 13. Morphology and Taxonomy of Spermatophytes. — 16. Plant Ecology. — 18. Advanced Physiology. — 19. Water and Sewage Purification.

RESEARCH UNDER SUPERVISION. — Taxonomy. — Applied Mycology. — Physiology.

INDEPENDENT RESEARCH, in any field for which the necessary equipment is available, is open to persons qualified by training and experience to carry it on without instruction. To such advanced investigators the utmost freedom is allowed, and all the facilities of the School of Botany and the Botanical Garden are placed at their disposal free of expense, unless their work is done in candidacy for a degree, in which case the prescribed fees are chargeable.

The electives offered to undergraduates and jointly to undergraduate and graduate students, are intended in a general way to indicate the breadth of botanical preparation expected of successful candidates for the Master's degree in botany; while the research courses indicate the field in which work leading to the Doctor's degree may now be undertaken.

Undergraduate work, in the year just closed, has differed little from that of several seasons past. From the opening of the current college year, Mr. C. D. Learn, as Teaching Fellow in Botany, has continued the assistant's work performed last year by Mr. Nehrling. The undergraduate enrollment for the first term of 1909-10 was: Biology, eight, Botany 1, twenty; Botany 3, seven; Botany 5, five—a total of forty students, of whom the eight first noted give equal time to botany and zoology and the others take one full botanical course each.

On the completion of the new building at the Garden, one three-story pavilion, about fifty feet square, was reserved for use in connection with the graduate needs of the School of Botany and independent research, and an excellent equipment has been provided for work in bacteriology and other branches of mycology, phycology, and certain lines of plant physiology. In these directions research work, under the immediate direction of Professor Moore, is being carried out by four candidates for advanced degrees; while another applicant for the Master's degree is giving a part of his time to less advanced graduate study.

GARDEN PUPILS.

In March, Mr. Arno H. Nehrling and Mr. Henry Ochs, who had completed the prescribed course of study and passed an examination satisfactory to the Garden Committee, were given the customary certificates; and in June, Miss Herta A. Toeppen, who had also completed the required course and passed the requisite examination, was granted a similar certificate. On the results of competitive examination, duly announced, the scholarships released by Mr. Nehrling and Mr. Ochs were awarded to Mr. Clark Craig, of Rush Lake, Wisconsin, and Mr. Carl Haltenhoff, of Gotha, Florida. In June Mr. Raymond B. Wilcox, for family reasons, gave up the scholarship which he had held since 1907, and it was given to Mr. Homer E. Reed, of Louisiana, Missouri, who had ranked highest among the unsuccessful competitors for the two scholarships awarded in the spring. At the end of December, the scholarship held by Mr. Jesse B. Tuggle was relinquished, and is still free.

No changes have been made during the year in the teaching staff or the prescribed course of study; but several of the Garden pupils have found time for additional work, of college grade, as special students in Washington University.

THE GARDEN STAFF.

Aside from a few changes among library assistants engaged temporarily in indexing and cataloguing, no changes are to be reported further than the addition of Professor Moore, already referred to. As in previous years, I can not too warmly commend the cheerful and efficient assistance that has been rendered by my associates, in caring for the important collections to which the Garden owes its chief value as an establishment for research, and I am especially indebted to Miss Hogan and Miss Brown for important contributions to the last Garden Report.

SPECIAL TESTAMENTARY PROVISIONS.

Three of the annual events provided for in the will of Mr. Shaw have taken place in 1909.

The flower sermon was preached in Christ Church Cathedral, St. Louis, on the morning of May twenty-third, by Rt. Reverend F. K. Brooke, Bishop of Oklahoma.

The sum set apart for floral premiums was once more entrusted to the St. Louis Horticultural Society, for use in connection with an exhibition held between November ninth and twelfth, but no award was made of the Shaw Medal.

The twentieth Gardeners' banquet, in the form of an open-air collation, was given in the grounds of the Director's residence at the Garden on July first; some 150 persons being present, of whom many were in attendance at the summer meeting of the State Board of Horticulture.

Very respectfully,
William Trelease,
Director.